


Using X-Rays to Determine Stress

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Outline

- 3-D Printing
 - Residual Stress
 - Non-Destructive Evaluation
 - X-Ray Diffraction
 - System and Background
 - Results
 - Conclusion
- 


3D Printing

“the process of joining materials to make objects from a 3D model data, usually layer upon layer”

- **History**

- Process is an ongoing evolution: every 9 months
- 21st Century strides

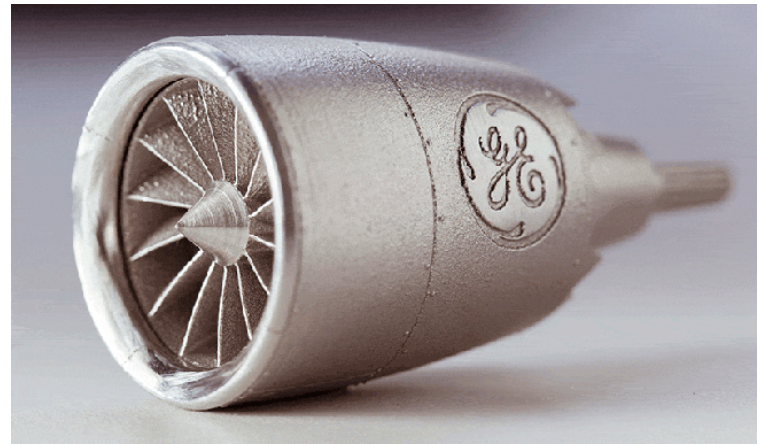
- **Applications**

- Cars, airplanes, houses
 - Medical implants
 - Electronic components
 - Scale models
 - Just about anything
- 



Additive Manufacturing: Metals

- **First: Traditional techniques**
- **Why additive manufacturing?**
 - Cheaper
 - Faster
 - Complex parts
- **The Process**







Residual Stresses

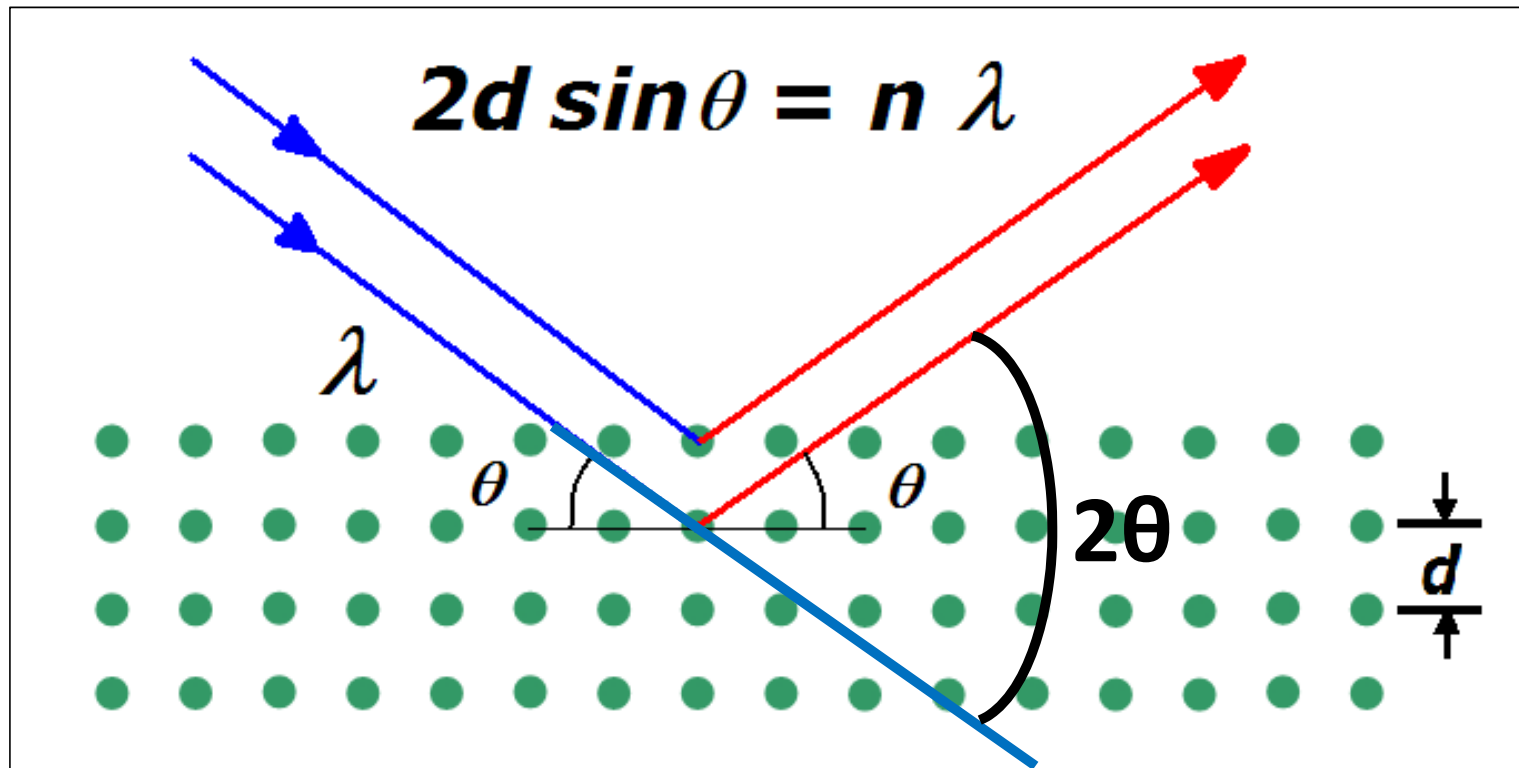
Self-balanced stresses caused by incompatible internal strains. They may be generated or modified at every stage in the component life cycle.



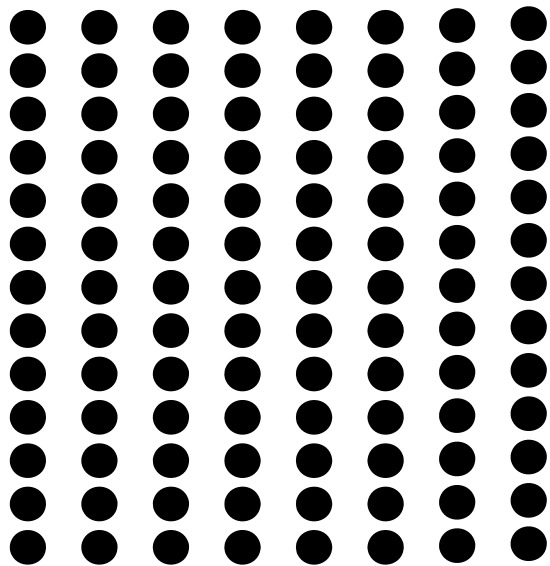
Non-Destructive Evaluation

- **What is it?**
- **Why is it important?**
- **Types**
 - Eddy Current
 - CT Imaging
 - Ultrasound
 - X-Ray Diffraction

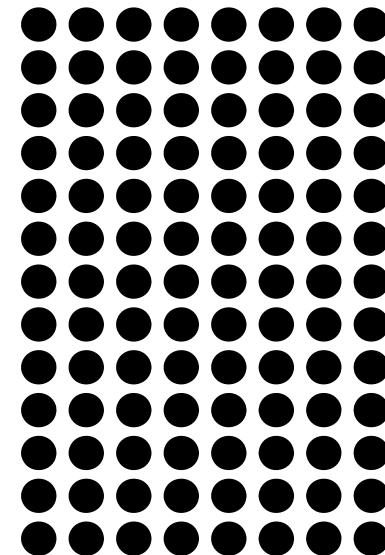
Bragg's Law



Normal vs Strained Atomic Structure

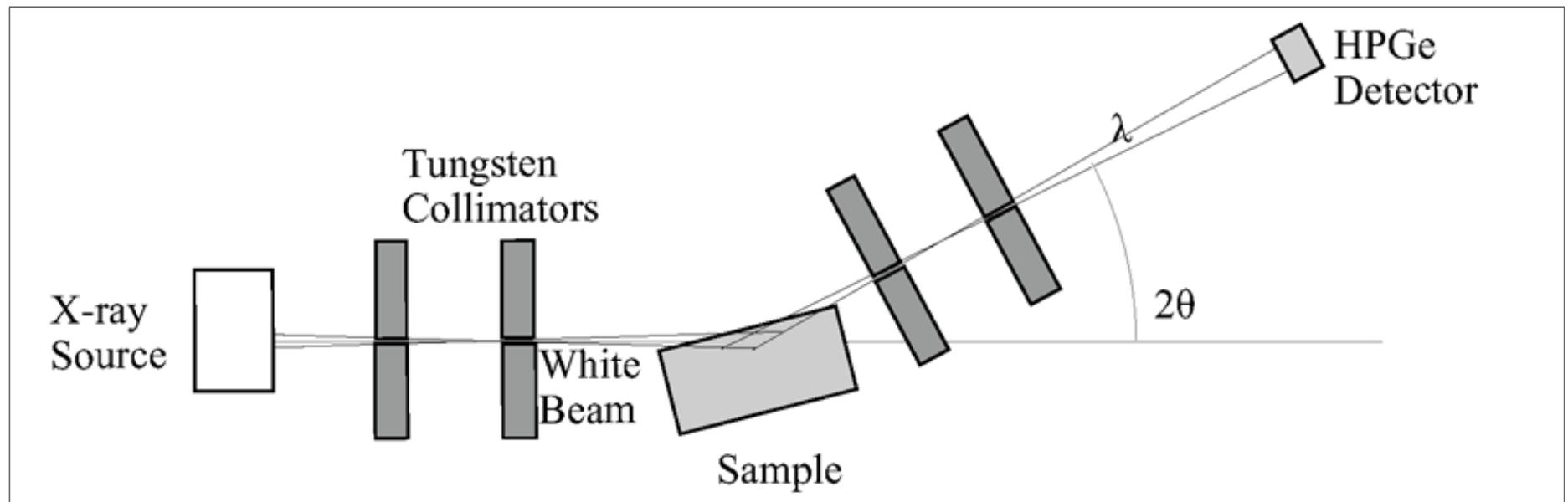


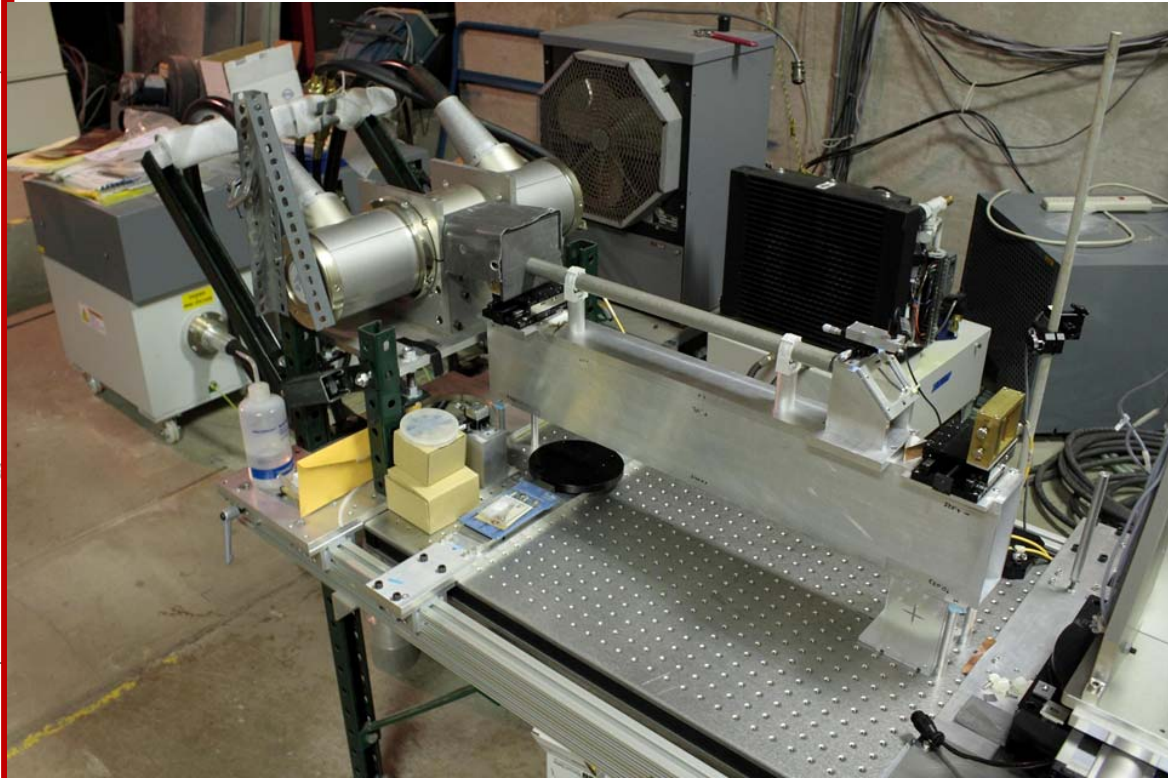
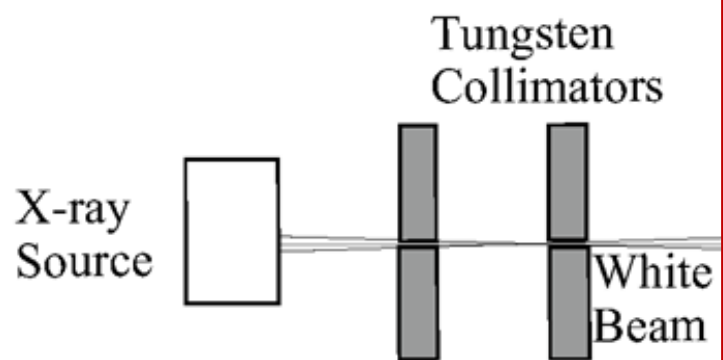
Good Diffraction

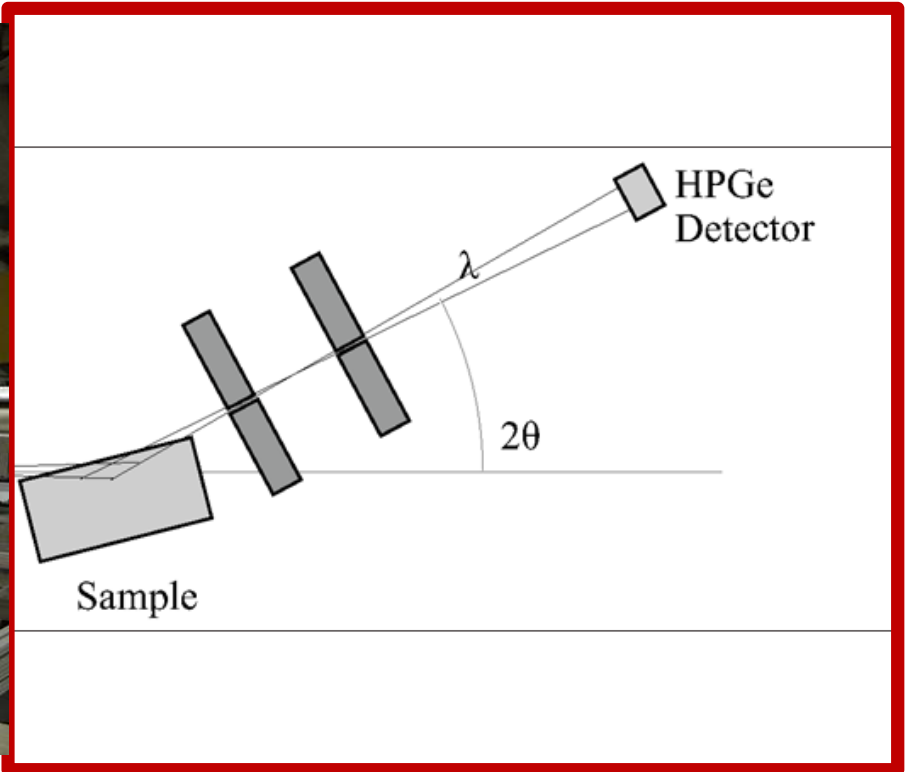


Diffraction with Stress
Profiles

The System



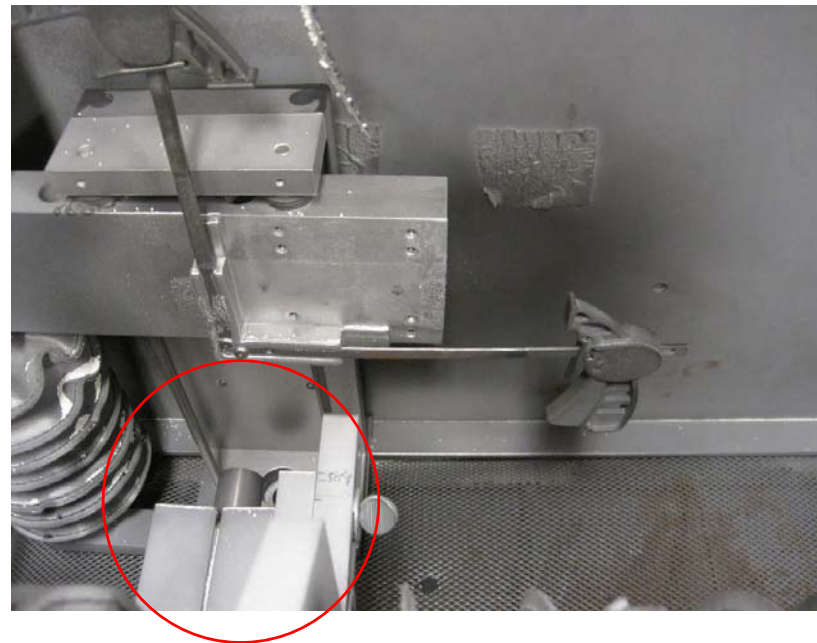




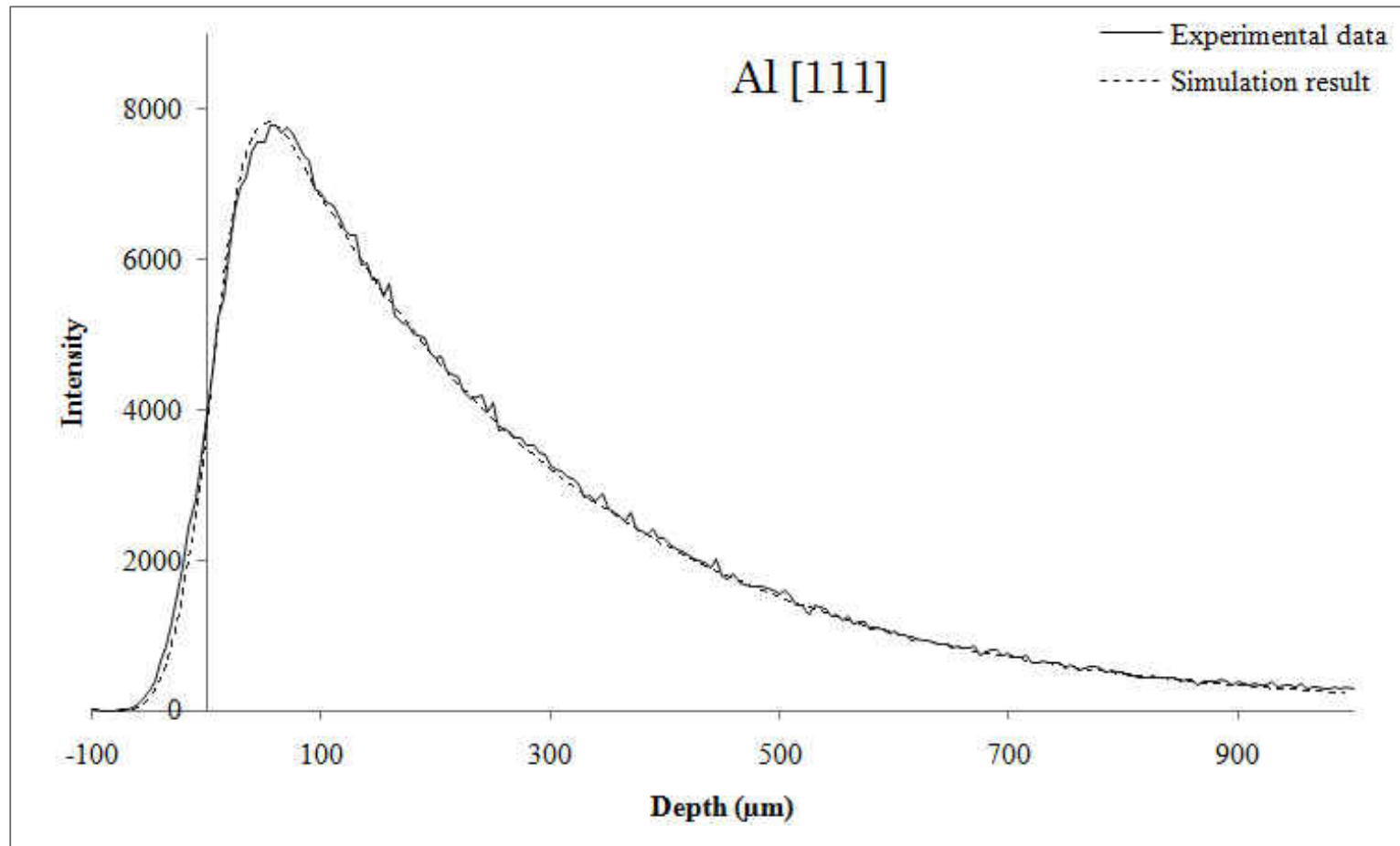
Slide 15

MAA1 What does Detector stand for? High Purity?
McKenna, Ashley A, 4/8/2015

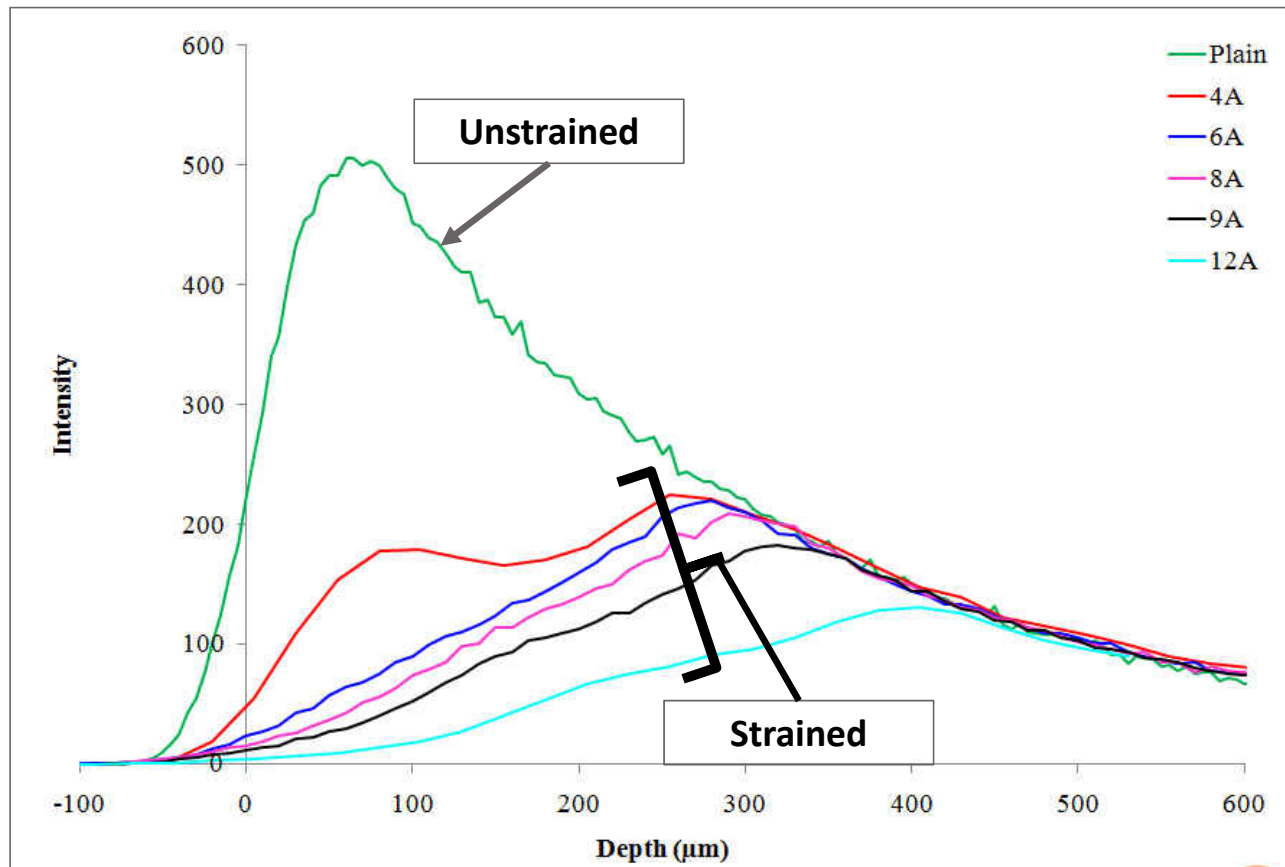
Shot Peening



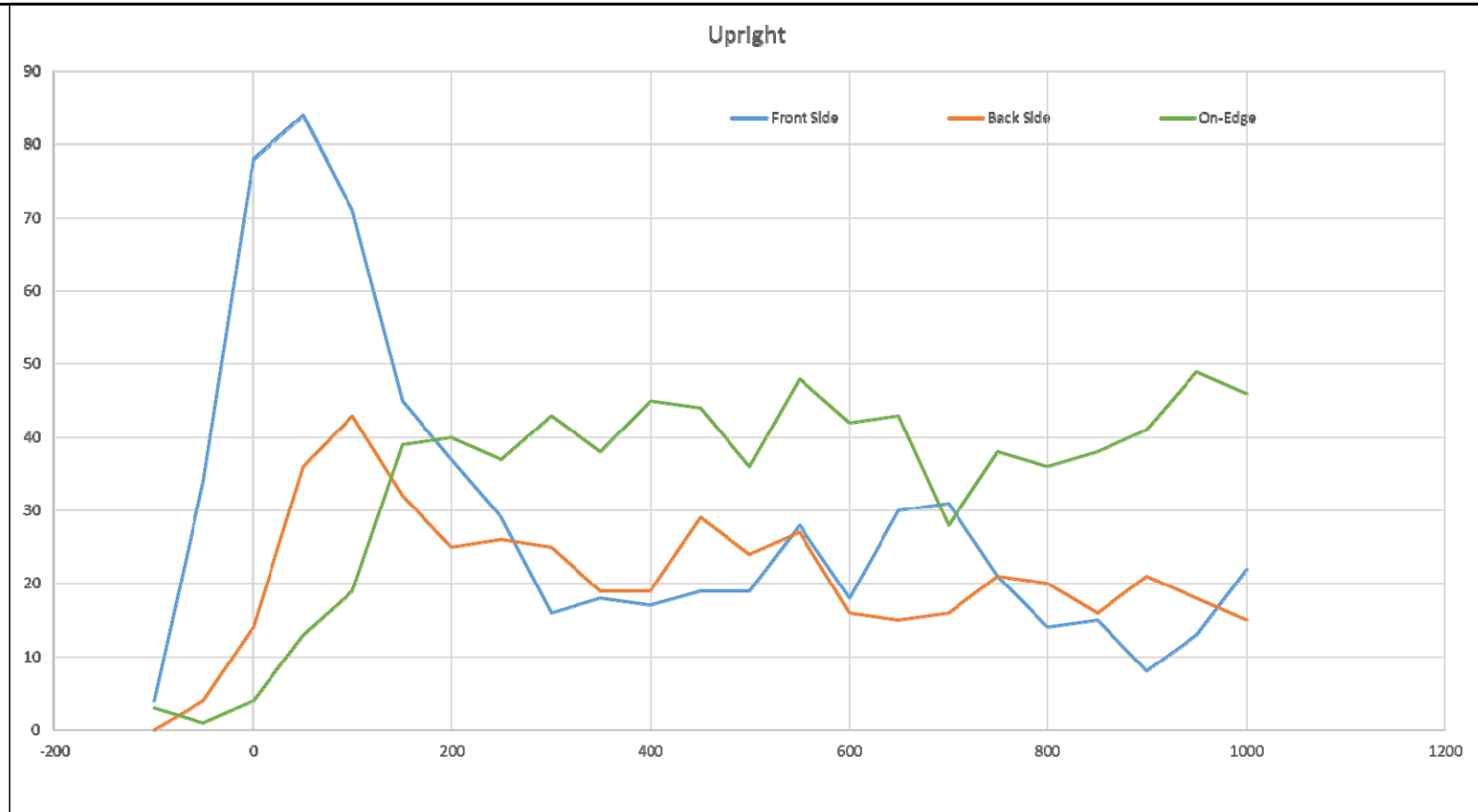
Unstrained Scan Profile: No residual stress



Scan Profiles with residual stress



3D Printed Samples



Conclusion

- Our 3D printed samples show a variety of strain profiles
- **Still many unknowns**
 - Production techniques
 - Materials
 - Desired applications

Thank you!

Are there any questions?

Works Cited

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Additional Slides

